DØ COLLISION HALL OUTSIDE AIR MAKEUP MONITORING

ENGINEERING NOTE

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SCOPE: DØ engineering note #332 has calculated that the probability of a component failure and 2800 cfm of outside air added to the collision will maintain an ODH class 0. This does not imply that there is an oxygen deficient area if the 2800 cfm is not supplied. Nor does it imply that if a component failed with the 2800 cfm supplied that the collision hall would not have an oxygen deficient area. This note will briefly describe the collision hall ventilation system and how DØ will monitor outside air makeup and what will happen in the event of system failures.

Objective: We have concluded that continuously and quantitatively measuring air flow through large ducts is difficult and inaccurate. We also believe that air blowers are either running or not running, that is that, there is no likely case where the blower is delivering a partial amount of its original load.

DØ intends to demonstrate that the air handling systems for the collision hall currently delivers and removes the minimum of 2800 cfm and that if AHU1 and EF-7 are on, that the minimum of 2800 cfm's is guaranteed.

EF-6 & EF-7 Operation: EF-6(13,000 cfm) and EF-7 (4500 cfm) pull air out of the collision hall via the calorimeter spill trough-duct network and discharge it in the South parking lot outside. EF-6 is emergency ventilation and is energized during certain conditions such as an ODH alarm. We will deal with EF-7 here since it is **normal** ventilation.

EF-7 has a rated capacity of 4500 cfm and a measured flow of 5600 cfm. This flow is split into 3 streams. They are pipe chase(100 cfm), assembly hall(900 cfm), and the balance from the collision hall spill trough. EF-7 is monitored by a paddle switch in the discharge duct directly above the blower. The paddle switch is manufactured by Rotron, model 2A, and is spring loaded. It is activated by the air movement upward through the blower pushing the lever arm up against the spring. We know from measurements that the threshold for both increasing and decreasing air flow for this switch is at 600 cfm.

AHU1 operation: AHU1 is the fixed building ventilation blower that circulates air in the collision hall for HVAC reasons. AHU1 discharges air high into the collision hall and returns air from low in the collision hall. AHU1's capacity rating is 18,000 cfm, however it has been measured to be 19,200 cfm.

AHU1 has 3 controllable dampers (see attached sketch). One of these dampers controls the percentage of AHU1's air stream that is outside air. This damper will have a mechanical stop such that it can never close past the point, that AHU1's air stream has less than 4500 cfm of outside air.

AHU1's operation is monitored by a differential pressure switch measuring the static difference between the discharge duct of AHU1 and the inlet duct of AHU1. This pressure switch is manufactured by Penn, model #P32AF-2, adjustable from .05" to 5 " w.c..

Measuring Air Flow: Since most of the ducts involved are over 3' in diameter and have many bends, the flow through them is very turbulent. A cross section of any of these ducts has a very uneven distribution of velocities contained in it. This uneven distribution

of velocities is also what makes the air flow difficult to continuously measure and quantify.

The "measured flows" referred to in this note were measured using a hand held velocity meter. The method of measuring is by taking many readings across the opening of a duct and averaging them together, then multiplying by the cross sectional area to get a result in CFM.

This method of physically measuring the air flow will be used at least once during setup of EF-7 and AHU1. The computer controls for AHU1 do monitor outside air, collision hall return, and collision hall supply temperature. The outside air percentage of total air flow can be calculated using these temperatures. This calculated percentage will be used for a double check of the measured outside air flow. We cannot use this calculated percentage for continuous monitoring because, as the outside air temperature approaches the collision hall temperature the accuracy of the calculation drops way off until they are equal, then the percentage is incalculable.

Reliability of Measuring Air Flow: The paddle switches on EF-7 and EF-6 are wired using a method known as fail-safe. It is fail-safe because if the signal is lost it is considered failed by the programmed logic. This protects against things like cut cables and blown fuses from giving false indications of operation. These two paddle switches have been installed for two years. They have never given us the indication of a blower performing properly when it was not.

AHU1 uses a pressure differential switch from inlet to outlet of the blower. It will also be wired in a fail-safe configuration. We will measure this pressure differential and set the pressure switch at 50% of this pressure. This will insure that the switch has stable action and isn't set to close to 0psid, where it might be possible for the switch to give a false indication of the blower status.

System Failures: DØ engineering note #332 requires 2800 cfm outside air continuously supplied to the collision hall to keep the collision hall an ODH class 0. The following failures will cause the corresponding actions.

1. EF-6 & EF-7 Failure -Energize collision hall ODH horns and strobes

2. AHU1 Failure -Energize collision hall ODH horns and strobes

System Responses: The detector platform has 14 ODH monitoring heads strategically located throughout it. The following events are automatic equipment responses to help alleviate the hazard.

1. Pit Halon Dump -Deenergize EF-6 & EF-7

2. Collision hall ODH Alarm - Opens AHU1's outside air intake to 100%

3. Collision hall ODH alarm - EF-6 energizes(13,000 cfm)

4. EF-7 Fails - EF-6 energizes(13,000 cfm)

5. Commercial Power Failure - EF-6, EF-7, and AHU1 transfer to emergency diesel generator power

Conclusion: The air flow paths and ducts at DØ for both AHU1 and EF-7 are fixed. The blower throughputs are not variable. We will set the mechanical stop on AHU1's damper for a minimum of 4500 cfm. When all dampers are fixed we will take a measurement to assure that AHU1 has a minimum outside air makeup of 4500 cfm and EF-7 has a minimum exhaust ventilation 0f 4500.

AHU1 and EF-7 both have monitoring that can determine reliably as to whether the respective blower is on or off. Since the outside air makeup is fixed as long as the blowers are running, we can rely on the blower status indicators to determine as to whether the collision hall is receiving its 2800 cfm of outside makeup air.

APPENDIX A

DØ COLLISION HALL VENTILATION SAFETY SYSTEM TEST PROCEDURE

This test will temporarily shut down DØ's collision hall ventilation as well as sound the detector platforms hazardous atmosphere's horns. It is recommended that during this test the collision hall be emptied of personnel other than the testing observer.

People required: with 2 way radios

1. 1 or more DØ cryo expert
2. 1 DØ building manager (Pete Simon)
3. 1 HVAC person (Marty Laferrara)
4. 1 DØ Collision Hall observer
5. 1 Floating Observer

Procedure:

1. Notify FIRUS, SOD operator, and the CDF Cryo operator of the DØ alarms you will activate.
2. Make announcement on building PA system.
3. Bypass Auto-Dialer

EF-6 AND EF-7 FAILURE

1. Turn off power to EF-6 & EF-7
   - A. AHU1 intake louver open to 100%?_____
   - B. Collision Hall ODH horns and lights on?_____
   - C. Platform page show EF-6 and EF-7 failure?_____
2. Turn on power to EF-6 &EF-7, reset alarms.

COLLISION HALL ODH ALARM

1. Force cryo PLC output to activate Collision Hall ODH alarm.
   - A. AHU1 intake louver open to 100%?_____
   - B. Collision Hall ODH horns and lights on?_____
   - C. EF-6 on?_____
2. Unforce cryo PLC output to activate Collision Hall ODH alarm, reset alarms.

AHU1 FAILURE

1. Turn off AHU1.
   - A. Collision Hall ODH horns and lights on?_____
   - B. Platform page show AHU1 failure?_____
2. Turn on AHU1, reset alarms.

COLLISION HALL HALON DUMP

9. Activate Halon Dump signal to cryo PLC.
   - A. EF-6 and EF-7 off?_____
   - B. Collision Hall ODH horns and lights on?_____
   - C. Platform page show "Halon Dumped"?_____

D. AHU1 intake louver open to 100%?_____

Participants

_____DATE_____

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